PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* PG3614/ PCT

Box No. I TITLE OF INVENTION

Medicament Delivery System

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below).*

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☐ This person is also inventor.

Telephone No. 0171 493 4060

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State *(i.e. country)* of nationality: GB

State *(i.e. country)* of residence: GB

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANTS AND/OR (FURTHER) INVENTORS

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

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SG12 ODP
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This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(i.e. country)* of nationality: GB

State *(i.e. country)* of residence: GB

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country).*

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☐ Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Express Mail Label
EL 395894865US

Continuation of Box No. III FURTHER APPLICANTS AND/OR (FURTHER) INVENTORS

If none of the following sub-boxes is used, this sheet is not to be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

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- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(i.e. country)* of nationality: GB

State *(i.e. country)* of residence: GB

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(i.e. country)* of nationality:

State *(i.e. country)* of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(i.e. country)* of nationality:

State *(i.e. country)* of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(i.e. country)* of nationality:

State *(i.e. country)* of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

☒ **AP** **ARIPO Patent:** **GH** Ghana, **GM** Gambia, **KE** Kenya, **LS** Lesotho, **MW** Malawi, **SD** Sudan, **SL** Sierra Leone, **SZ** Swaziland, **TZ** United Republic of Tanzania, **UG** Uganda, **ZW** Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT

☒ **EA** **Eurasian Patent:** **AM** Armenia, **AZ** Azerbaijan, **BY** Belarus, **KG** Kyrgyzstan, **KZ** Kazakhstan, **MD** Republic of Moldova, **RU** Russian Federation, **TJ** Tajikistan, **TM** Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT

☒ **EP** **European Patent:** **AT** Austria, **BE** Belgium, **CH and LI** Switzerland and Liechtenstein, **CY** Cyprus, **DE** Germany, **DK** Denmark, **ES** Spain, **FI** Finland, **FR** France, **GB** United Kingdom, **GR** Greece, **IE** Ireland, **IT** Italy, **LU** Luxembourg, **MC** Monaco, **NL** Netherlands, **PT** Portugal, **SE** Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT

☒ **OA** **OAPI Patent:** **BF** Burkina Faso, **BJ** Benin, **CF** Central African Republic, **CG** Congo, **CI** Côte d'Ivoire, **CM** Cameroon, **GA** Gabon, **GN** Guinea, **GW** Guinea-Bissau, **ML** Mali, **MR** Mauritania, **NE** Niger, **SN** Senegal, **TD** Chad, **TG** Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* .....

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

☒ **AE** United Arab Emirates
☒ **AL** Albania .....
☒ **AM** Armenia .....
☒ **AT** Austria .....
☒ **AU** Australia .....
☒ **AZ** Azerbaijan
☒ **BA** Bosnia and Herzegovina .....
☒ **BB** Barbados
☒ **BG** Bulgaria .....
☒ **BR** Brazil .....
☒ **BY** Belarus .....
☒ **CA** Canada
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☒ **CN** China .....
☒ **CR** Costa Rica .....
☒ **CU** Cuba .....
☒ **CZ** Czech Republic .....
☒ **DE** Germany .....
☒ **DK** Denmark .....
☒ **DM** Dominica
☒ **EE** Estonia .....
☒ **ES** Spain .....
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☒ **GE** Georgia .....
☒ **GH** Ghana .....
☒ **GM** Gambia
☒ **HR** Croatia .....
☒ **HU** Hungary .....
☒ **ID** Indonesia
☒ **IL** Israel .....
☒ **IN** India .....
☒ **IS** Iceland
☒ **JP** Japan .....
☒ **KE** Kenya .....
☒ **KG** Kyrgyzstan .....
☒ **KP** Democratic People's Republic of Korea .....
☒ **KR** Republic of Korea .....
☒ **KZ** Kazakhstan .....
☒ **LC** Saint Lucia
☒ **LK** Sri Lanka

☒ **LR** Liberia
☒ **LS** Lesotho .....
☒ **LT** Lithuania
☒ **LU** Luxembourg
☒ **LV** Latvia
☒ **MA** Morocco .....
☒ **MD** Republic of Moldova .....
☒ **MG** Madagascar .....
☒ **MK** The former Yugoslav Republic of Macedonia .....
☒ **MN** Mongolia
☒ **MW** Malawi .....
☒ **MX** Mexico .....
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☒ **TR** Turkey .....
☒ **TT** Trinidad and Tobago .....
☒ **TZ** United Republic of Tanzania
☒ **UA** Ukraine .....
☒ **UG** Uganda .....
☒ **US** United States of America .....
☒ **UZ** Uzbekistan .....
☒ **VN** Viet Nam .....
☒ **YU** Yugoslavia .....
☒ **ZA** South Africa .....
☒ **ZW** Zimbabwe .....

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

☐ .....
☐ .....

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)*

Box No. VI PRIORITY CLAIM ☐ Further priority claims are indicated in the Supplemental Box

Filing Date of Earlier Application *(day/month/year)*	Number of earlier application	Where earlier application is: national application: country	Where earlier application is: regional application:* regional Office	Where earlier application is: international application: receiving Office
item (1) (06.03.99) 6 March 1999	9905134.4	GB		
item (2) (27.07.99) 27 July 1999	9917470.8	GB		

☐ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): _____

* *Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earli application was filed (Rue 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):* ISA/

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority):* Date *(day/month/year)* Number Country *(or regional office)*

Box. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following **number of sheets:**

request	: 4
description (excluding sequence listing part)	: 12
claims	: 6
abstract	: 1
drawings	: 5
sequence listing part of description	:____
Total number of sheets	**: 28**

This international application is **accompanied by** the item(s) marked below:

1. ☑ fee calculation sheet
2. ☑ separate signed power of attorney
3. ☑ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☑ priority documents (2) identified in Box No. VI as item(s): 1and 2
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☐ other *(specify)*:

Figure of the drawings which should accompany the abstract: None

Language of filing of the international application: English

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Christopher Gerard Pike
Agent for the Applicants

For receiving Office use only

1. Date of actual receipt of the purported international application
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:
4. Date of timely receipt of the required corrections under PCT Article 11(2):
5. International Searching Authority specified by the applicant: ISA/
6. ☐ Transmittal of search copy delayed until search fee is paid

2. Drawings
☐ received:
☐ not received:

For International Bureau use only

Date of receipt of the record copy by the International Bureau

See Notes to the request form

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
PG3614/PCT		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP00/01443	23/02/2000	06/03/1999
International Patent Classification (IPC) or national classification and IPC A61M11/00		
Applicant GLAXO GROUP LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 6 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
10/08/2000	19.06.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Lager, J Telephone No. +49 89 2399 2957

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP00/01443

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-12	as originally filed

Claims, No.:

1-44	as received on	12/03/2001	with letter of	09/03/2001

Drawings, sheets:

1/5-5/5	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   - ☐ the description, pages:
   - ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

   ☐ the entire international application.

   ☒ claims Nos. 42-44.

because:

   ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

   ☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

   ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

   ☒ no international search report has been established for the said claims Nos. 42-44.

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

   ☐ the written form has not been furnished or does not comply with the standard.

   ☐ the computer readable form has not been furnished or does not comply with the standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

   Novelty (N) Yes: Claims 1-41

	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-41
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-41
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Section III.

1. Claims 42-44 relate to medical method, cf. Rule 67.1(iv) PCT, and have not been searched, see Rule 66.1(e) PCT.

Section V.

1. The closest prior art is represented by document US-A-5 813 397 which discloses a hand held microprocessor controlled inhaler device which discloses the features of the preamble of claim 1.
Document US-A-5 743 252 discloses a device similar to the device as disclosed in US-A-5 813 397.

1.1 The object of the present invention was to improve delivery of medicament in portable device such as disclosed in the two above mentioned documents.

This object is achieved by means of defining that the monitor provides a signal to the actuator for the release of a dose of medicament at a trigger point which is coupled to the end of the exhalation part of the breath cycle as defined in the characterising portion of claim 1.

None of the available prior art documents suggests to improve a portable device, such as disclosed in the two above mentioned documents, by means of a device as defined in the independent claim 1.

1.2 Independent claim 1 therefore fulfils the requirements of Article 33(2)-(3) PCT.

2. Dependent claims 2-41 define preferred embodiments of the device as defined in the independent claim 1.

3. Claims 1-41 thus meets the requirements of Article 33(2)-(4) PCT.

Section VII.

1. The features of the claims are not provided with reference signs placed in

parentheses (Rule 6.2(b) PCT).

2. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents US-A-5 813 397 and US-A-5 743 252 is not mentioned in the description, nor are these documents identified therein.

Section VIII.

1. The vague and imprecise statement in the description on page 12, last paragraph, implies that the subject-matter for which protection is sought may be different to that defined by the claims, thereby resulting in lack of clarity (Article 6 PCT) when used to interpret them (see also the PCT Guidelines, III-4.3a).

CLAIMS:

1. A system for the delivery of inhalable medicament comprising

a monitor for monitoring the breath cycle of a patient;

a medicament container having a release mechanism for releasing inhalable medicament therefrom; and

an actuator for actuating said release mechanism, said actuator being actuable in response to a signal from said monitor,

characterized in that the monitor provides said signal at a trigger point which is coupled to the end of the exhalation part of the breath cycle.

2. A system according to claim 1, wherein said monitor comprises one or more sensors for sensing the pressure profile associated with the breath cycle.

3. A system according to either of claims 1 or 2, wherein said monitor comprises one or more sensors for sensing the airflow profile associated with the breath cycle.

4. A system according to any of claims 1 to 3, wherein said monitor comprises one or more sensors for sensing the temperature profile associated with the breath cycle.

5. A system according to any of claims 1 to 4, wherein said monitor comprises one or more sensors for sensing the moisture profile associated with the breath cycle.

6. A system according to any of claims 1 to 5, wherein said monitor comprises one or more sensors for sensing the oxygen or carbon dioxide profile associated with the breath cycle.

7. A system according to any of claims 1 to 6, wherein the trigger point corresponds to the point at which the lungs of the patient are most empty.

8. A system according to any of claims 1 to 7, wherein said monitor is connectable to an electronic information processor.

9. A system according to claim 8, wherein said electronic information processor includes an active memory for storing information about the breath cycle.

10. A system according to claim 9, wherein said electronic information processor includes a predictive algorithm for predicting the optimum trigger point.

11. A system according to claim 9, wherein said electronic information processor includes a look-up table for predicting the optimum trigger point.

12. A system according to any of claims 9 to 11, wherein said electronic information processor includes a second predictive algorithm for predicting the optimum amount of medicament to release.

13. A system according to any of claims 9 to 11, wherein said electronic information processor includes a second look-up table for predicting the optimum amount of medicament to release.

14. A system according to either of claim 12 or 13, wherein said electronic information processor includes a dose memory for storing information about earlier delivered doses and reference is made to the dose memory in predicting the optimum amount of medicament to release.

15. A system according to any of claims 12 to 14, additionally comprising a display for displaying information about the optimum amount of medicament to release.

16. A system according to any of claims 12 to 15, additionally comprising a selector for selecting the amount of medicament to release.

17. A system according to claim 16, wherein the selector is manually operable.

18. A system according to claim 16, wherein the selector is operable in response to a signal from the electronic information processor.

19. A system according to any of claims 16 to 18, wherein the selector comprises a timing mechanism for varying the time interval of actuation of the actuator.

20. A system according to any of claims 16 to 19, wherein the selector comprises a metering mechanism between the container and the release mechanism for metering a variable quantity of medicament for release.

21. A system according to any of claims 16 to 20, wherein the selector comprises a multiple-fire mechanism for multiple actuation of the actuator, wherein each actuation releases a portion of the optimum amount of medicament.

22. A system according to any of claims 1 to 21, wherein said medicament container is an aerosol container and said release mechanism is an aerosol valve.

23. A system according to claim 22, wherein said aerosol valve includes a metering chamber for metering the release of medicament.

24. A system according to claim 23, wherein the metering chamber has a variable metering volume.

25. A system according to claim 24, wherein the metering chamber comprises a chamber of fixed volume which metering volume is variable by insertion of a plunger or piston.

26. A system according to claim 24, wherein the metering chamber is formed from an expandable material.

27. A system according to claim 24, wherein the metering chamber has a telescopic or concertina arrangement.

28. A system according to any of claims 1 to 21, wherein said medicament container is a dry-powder container or a liquid container.

29. A system according to any of claims 1 to 28, wherein said actuator comprises an energy store for storing energy which energy is releasable to activate the release mechanism of the medicament container.

30. A system according to claim 29, wherein said energy store comprises a biasable resilient member.

31. A system according to claim 30, wherein said biasable resilient member is a spring.

32. A system according to claim 29, wherein said energy store comprises a source of compressed fluid, preferably compressed gas.

33. A system according to claim 29, wherein said energy store comprises a voltaic cell or battery of voltaic cells.

34. A system according to claim 29, wherein said energy store comprises a chemical energy source, preferably a chemical propellant or ignition mixture.

35. A system according to claim 29, wherein said energy store comprises a physically explosive energy source.

36. A system according to any of claims 1 to 35, additionally comprising a safety mechanism to prevent unintended multiple actuations of the actuator.

37. A system according to claim 36, wherein said safety mechanism imposes a time delay between successive actuations of the actuator.

38. A system according to any of claims 1 to 37, additionally comprising an actuation counter.

39. A system according to any of claims 1 to 38, additionally comprising a medicament release counter, preferably a dose counter.

40. A system according to any of claims 1 to 39, additionally comprising a manual override.

41. An inhalation device for the delivery of inhalable medicament comprising a housing and a system according to any of claims 1 to 40.

42. A method for the delivery of inhalable medicament to a patient comprising

(i) monitoring the breath cycle of a patient by use of a monitor;

(ii) at a trigger point, sending an actuation signal from said monitor to an actuator;

(iii) on receipt of said actuation signal by said actuator, actuating the release of inhalable medicament to the patient,

characterized in that said trigger point is coupled to the end of the exhalation part of the breath cycle.

43. Method according to claim 42, wherein steps (i) to (iii) are repeated until the breath cycle corresponds to a medically acceptable form.

44. Method according to claim 42, comprising

(i) monitoring a plurality of breath cycles of a patient by use of a monitor;

(ii) analysing said plurality of breath cycles to define an averaged breath cycle for the patient;

(iii) predicting a trigger point from said averaged breath cycle, the trigger point being coupled to the end of the exhalation part of the averaged breath cycle;

(iv) monitoring a further breath cycle and at said predicted trigger point sending an actuation signal from said monitor to an actuator;

(v) on receipt of said actuation signal by said actuator, actuating the release of inhalable medicament to the patient.

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 :
A61M 11/00, 15/00, 16/00

A1

(11) International Publication Number: WO 00/53247

(43) International Publication Date: 14 September 2000 (14.09.00)

(21) International Application Number: PCT/EP00/01443

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(30) Priority Data:

9905134.4	6 March 1999 (06.03.99)	GB
9917470.8	27 July 1999 (27.07.99)	GB

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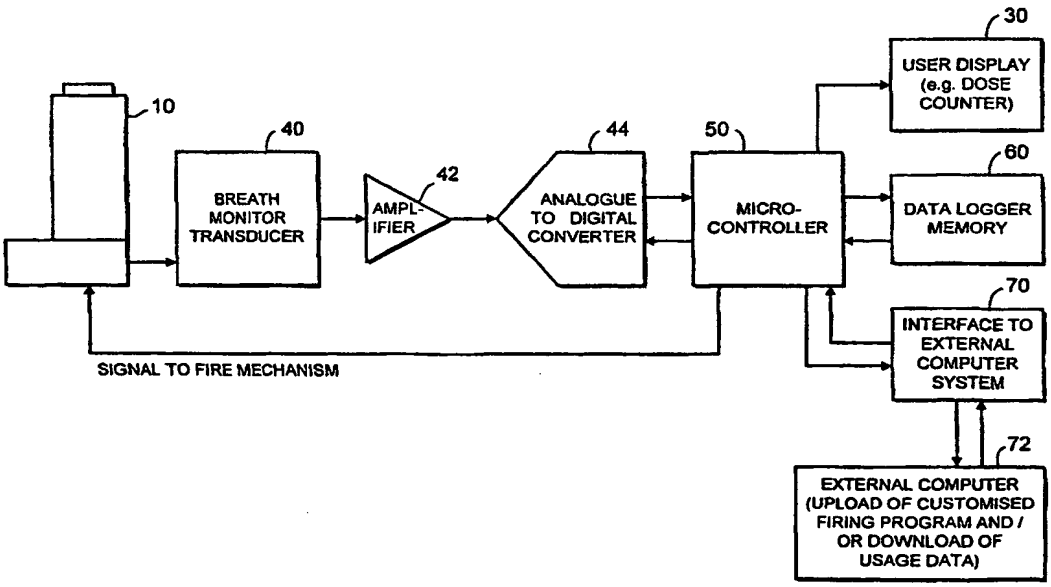
(54) Title: MEDICAMENT DELIVERY SYSTEM



(57) Abstract

There is provided a system for the delivery of inhalable medicament comprising a monitor (40) for monitoring the breath cycle of a patient, a medicament container (2) having a release mechanism (4, 5) for releasing inhalable medicament therefrom, and an actuator (50) for actuating said release mechanism, the actuator (50) being actuable in response to a signal from the monitor (40). The monitor (40) provides the signal at a trigger point which is coupled to the end of the exhalation part of the breath cycle.

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 00/01443

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61M11/00 A61M15/00 A61M16/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 92 12750 A (VORTRAN MEDICAL TECHNOLOGY INC) 6 August 1992 (1992-08-06) abstract page 3, line 27 -page 4, line 30 page 9, line 25 -page 12, line 34 page 13, line 28-34 figures	1,2, 7-21,28, 32,38-41
Y		3,4,22, 23, 29-31, 36,37
A		5,6, 24-27, 33-35

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
1 August 2000	09.08.00

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lager, J

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INTERNATIONAL SEARCH REPORT

Inter. ɔnal Application No
PCT/EP 00/01443

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 813 397 A (GOODMAN DAVID E ET AL) 29 September 1998 (1998-09-29)	3,22,23, 36,37
A	abstract	1,2, 4-21, 24-35
	column 1, line 17-21 column 4, line 65 -column 7, line 20 column 12, line 16-46 column 16, line 11-27 column 17, line 19-34 figures	

Y	US 5 743 252 A (RUBSAMEN REID M ET AL) 28 April 1998 (1998-04-28) abstract column 4, line 15-45 column 6, line 30-50	4
A	column 7, line 1 -column 8, line 19	1-3,5-41

Y	US 5 520 166 A (RITSON CARL ET AL) 28 May 1996 (1996-05-28)	29-31
A	abstract; figures 6-11 column 14, line 29-60 column 15, line 55 -column 18, line 3	1-28, 32-41

A	US 5 608 647 A (RUBSAMEN REID M ET AL) 4 March 1997 (1997-03-04) abstract; figures column 3, line 49 -column 5, line 20	1-41

A	US 5 469 750 A (LLOYD PETER M ET AL) 28 November 1995 (1995-11-28) abstract column 4, line 11-63 column 6, line 60 -column 8, line 18	1-41

A	WO 99 04841 A (NORDMAN CATHERINE A ;SCHMIDT MATTHEW F (US); BUAN JOHN S (US); MIN) 4 February 1999 (1999-02-04) abstract	5,6

A	US 5 842 467 A (GRECO MICHAEL) 1 December 1998 (1998-12-01) figures	24,26

A	US 3 695 263 A (KIPLING BARRY JOHN) 3 October 1972 (1972-10-03) figures	25

A	US 4 176 663 A (HEWLETT ANTHONY M) 4 December 1979 (1979-12-04) figures	27

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP 00/01443

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [X] Claims Nos.: 42-44
because they relate to subject matter not required to be searched by this Authority, namely:

Rule 39.1(iv) PCT - Method for treatment of the human or animal body by therapy

2. [ ] Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. [ ] Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. [ ] As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest.

[ ] No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte. .ional Application No
PCT/EP 00/01443

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9212750 A	06-08-1992	US 5322057 A	21-06-1994
		AU 1342092 A	27-08-1992
		CA 2099665 A	25-07-1992
		EP 0568648 A	10-11-1993
		JP 6505184 T	16-06-1994
US 5813397 A	29-09-1998	US 5655516 A	12-08-1997
		US 5542410 A	06-08-1996
		US 5404871 A	11-04-1995
		US 5826570 A	27-10-1998
		AT 188617 T	15-01-2000
		CA 2082168 C	26-03-1996
		DE 69230546 D	17-02-2000
		DE 69230546 T	21-06-2000
		EP 0529053 A	03-03-1993
		ES 2141104 T	16-03-2000
		JP 9164205 A	24-06-1997
		JP 2613347 B	28-05-1997
		US 5394866 A	07-03-1995
		US 5469750 A	28-11-1995
		US 5450336 A	12-09-1995
		US 5392768 A	28-02-1995
		WO 9215353 A	17-09-1992
		US 5522378 A	04-06-1996
		US 5622162 A	22-04-1997
		US 5497764 A	12-03-1996
		US 5520166 A	28-05-1996
		US 5608647 A	04-03-1997
		US 5743252 A	28-04-1998
		US 5755218 A	26-05-1998
US 5743252 A	28-04-1998	US 5608647 A	04-03-1997
		US 5450336 A	12-09-1995
		US 5404871 A	11-04-1995
		AU 6130594 A	15-08-1994
		EP 0683890 A	29-11-1995
		JP 8509545 T	08-10-1996
		WO 9417370 A	04-08-1994
		AT 188617 T	15-01-2000
		CA 2082168 C	26-03-1996
		DE 69230546 D	17-02-2000
		DE 69230546 T	21-06-2000
		EP 0529053 A	03-03-1993
		ES 2141104 T	16-03-2000
		JP 9164205 A	24-06-1997
		JP 2613347 B	28-05-1997
		US 5394866 A	07-03-1995
		US 5469750 A	28-11-1995
		US 5392768 A	28-02-1995
		WO 9215353 A	17-09-1992
		US 5522378 A	04-06-1996
		US 5542410 A	06-08-1996
		US 5622162 A	22-04-1997
		US 5497764 A	12-03-1996
		US 5520166 A	28-05-1996
		US 5655516 A	12-08-1997
		US 5755218 A	26-05-1998
		US 5813397 A	29-09-1998

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte. ional Application No
PCT/EP 00/01443

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5743252 A		US 5826570 A	27-10-1998
US 5520166 A	28-05-1996	US 5497764 A	12-03-1996
		US 5404871 A	11-04-1995
		AT 188617 T	15-01-2000
		CA 2082168 C	26-03-1996
		DE 69230546 D	17-02-2000
		DE 69230546 T	21-06-2000
		EP 0529053 A	03-03-1993
		ES 2141104 T	16-03-2000
		JP 9164205 A	24-06-1997
		JP 2613347 B	28-05-1997
		US 5394866 A	07-03-1995
		US 5469750 A	28-11-1995
		US 5450336 A	12-09-1995
		US 5392768 A	28-02-1995
		WO 9215353 A	17-09-1992
		US 5522378 A	04-06-1996
		US 5542410 A	06-08-1996
		US 5622162 A	22-04-1997
		US 5608647 A	04-03-1997
		US 5655516 A	12-08-1997
		US 5743252 A	28-04-1998
		US 5755218 A	26-05-1998
		US 5813397 A	29-09-1998
		US 5826570 A	27-10-1998
US 5608647 A	04-03-1997	US 5450336 A	12-09-1995
		US 5404871 A	11-04-1995
		US 5743252 A	28-04-1998
		AU 6130594 A	15-08-1994
		EP 0683890 A	29-11-1995
		JP 8509545 T	08-10-1996
		WO 9417370 A	04-08-1994
		AT 188617 T	15-01-2000
		CA 2082168 C	26-03-1996
		DE 69230546 D	17-02-2000
		DE 69230546 T	21-06-2000
		EP 0529053 A	03-03-1993
		ES 2141104 T	16-03-2000
		JP 9164205 A	24-06-1997
		JP 2613347 B	28-05-1997
		US 5394866 A	07-03-1995
		US 5469750 A	28-11-1995
		US 5392768 A	28-02-1995
		WO 9215353 A	17-09-1992
		US 5522378 A	04-06-1996
		US 5542410 A	06-08-1996
		US 5622162 A	22-04-1997
		US 5497764 A	12-03-1996
		US 5520166 A	28-05-1996
		US 5655516 A	12-08-1997
		US 5755218 A	26-05-1998
		US 5813397 A	29-09-1998
		US 5826570 A	27-10-1998
US 5469750 A	28-11-1995	US 5404871 A	11-04-1995
		AU 6168194 A	15-08-1994

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte ional Application No
PCT/EP 00/01443

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5469750 A		WO 9417369 A	04-08-1994
		AT 188617 T	15-01-2000
		CA 2082168 C	26-03-1996
		DE 69230546 D	17-02-2000
		DE 69230546 T	21-06-2000
		EP 0529053 A	03-03-1993
		ES 2141104 T	16-03-2000
		JP 9164205 A	24-06-1997
		JP 2613347 B	28-05-1997
		US 5394866 A	07-03-1995
		US 5450336 A	12-09-1995
		US 5392768 A	28-02-1995
		WO 9215353 A	17-09-1992
		US 5522378 A	04-06-1996
		US 5542410 A	06-08-1996
		US 5622162 A	22-04-1997
		US 5497764 A	12-03-1996
		US 5520166 A	28-05-1996
		US 5608647 A	04-03-1997
		US 5655516 A	12-08-1997
		US 5743252 A	28-04-1998
		US 5755218 A	26-05-1998
		US 5813397 A	29-09-1998
		US 5826570 A	27-10-1998
WO 9904841 A	04-02-1999	AU 8592898 A	16-02-1999
		EP 0998318 A	10-05-2000
US 5842467 A	01-12-1998	NONE	
US 3695263 A	03-10-1972	CA 929067 A	26-06-1973
		DE 2003538 A	27-08-1970
		FR 2029721 A	23-10-1970
		GB 1248302 A	29-09-1971
		JP 49011834 B	19-03-1974
		NL 7001028 A	03-08-1970
		SE 375238 B	14-04-1975
		ZA 7000541 A	25-08-1971
US 4176663 A	04-12-1979	DE 2745336 A	19-04-1979
		GB 1592548 A	08-07-1981
		CA 1097557 A	17-03-1981
		FR 2366833 A	05-05-1978
		JP 53059293 A	27-05-1978